

Crafting new solutions to enhance Homeland Security

Through a half-century of national security work, Sandia has built up unparalleled capabilities in the science, technologies, systems analysis, and engineering needed to safeguard lives and assets against terrorist acts. We're now applying that expertise to support the Department of Homeland Security (DHS), creating technology-based systems to decrease the nation's vulnerability to terrorism. These systems benefit from a multi-disciplinary approach that fosters innovation. Our legacy of approaching work from a systems perspective ensures that our solutions provide end-to-end responses to real-world problems.

We are also committed to helping DHS put our solutions to work quickly. To this end, we test and deploy systems to protect public facilities, provide extensive training to first responders, and are active in international efforts to improve port security. One of our most notable achievements in 2004 was join-



ing with industry partners to sign the first CRADA that will result in a product with homeland security applications.

Chemical and biological security

Events such as the release of poison gas in the Tokyo subway and the delivery of letters in Washington, D.C. containing lethal doses of anthrax underscore the threat posed by chemical and biological weapons. Sandia is developing technology-based solutions to detect, deter, defeat, and mitigate the impact of chemical or biological attacks.

One such solution is MicroChemLab™, hand-portable, highly sensitive devices that can detect and identify a broad range of chem/bio agents rapidly with low false alarm rates. The result of a decade of work, this technology demonstrates Sandia's ability to innovate

"Today the technological challenges of protecting our nation against terrorism are as great as any we have faced in the past. In its role as a national security laboratory, Sandia began developing new technologies for the war against terrorism in the mid-1990s. These technologies are now playing an important role in guarding against biological, chemical, and radiological threats, as well as providing new capabilities for maintaining the health of infrastructures such as transportation, telecommunications, electrical transmission, water systems, national parks and monuments, and more."



Sandia and other national laboratories are serving as the wellspring for the integrated solutions that will maintain peace and freedom throughout the world."

Mim John

Vice President
California Laboratory





by integrating capabilities in an array of areas, including microsystems, chemistry, biology, and systems engineering. To place this tool into the hands of first responders, Sandia is moving quickly with commercialization plans.

Already, MicroChemLab™ Chemical Detectors have been at work under demanding real-world conditions at San Francisco International Airport and at a major subway in the northeast. In addition, Sandia-developed decontamination foam that renders all typical chem/bio agents harmless—now licensed to several commercial firms—was used in government and commercial buildings after the anthrax attacks in 2001.

The MicroChemLab™ Bio Detector is the core technology for Sandia's first major Homeland Security CRADA. Under this agreement, partners Tenix Investments and CH2M HILL will work with Sandia to produce the Unattended Water Safety System, which promises to enhance the safety of drinking water by automatically monitoring the water supply for previously undetected biological agents.

Other critical projects span the range of activities needed to prevent, prepare for, and respond to chem/bio threats. For example, Sandia is working with Lawrence Livermore National Laboratory to design and produce BioBriefcase, an automated, compact device that will continuously monitor for aerosol biological pathogens, working quickly and inexpensively, while providing excellent sensitivity and specificity.

To help the nation better protect heavily populated urban areas, we are contribut-

ing to a multi-lab study to define and explore planning scenarios for chem/bio attacks. By identifying capability gaps and vulnerabilities and metrics for evaluating countermeasures, the study will help the United States implement more effective defensive strategies.

And to provide immediate tools for protecting large facilities, we've developed operational strategies—based on tests at the San Francisco International Airport and elsewhere—to minimize human exposure to releases of chem/bio agents. These strategies are outlined in a report developed by Sandia and Lawrence Berkeley National Laboratory, being distributed to airport officials and security personnel.

Securing seaport and borders

Sandia is developing tools and expertise to help the nation respond to the new threat of potential terrorist activities at seaports and border crossings. We've been particularly active in helping secure the nation's seaports—points of entry for more than 95 percent of all freight from overseas. Aware that the nine million shipping containers enter these ports annually, officials are looking for solutions to ensure safe and profitable operation in these troubled times.





Work at the San Francisco International Airport takes a comprehensive approach to airport facility defense, including vulnerability assessment, tracer testing and modeling, facility hardening concepts, biological and chemical detection system testing, response planning, and simulation-based tabletop exercises.

One solution is Operation Safe Commerce-Pacific, an international partnership aimed at monitoring freight security from overseas points of origin to final U.S. destinations. Partners in this effort include U.S. Customs; U.S. Coast Guard; the nation's two largest ports, Los Angeles and Long Beach; and numerous private-sector technology providers.

In another effort, Sandia is refining its Sensor for Measurement and Analysis of Radiation Transients (SMART) to help screen containers. SMART not only detects radiation, but identifies specific isotopes, a critical advantage in efficiently identifying threats from among other sources of radiation. Field tests at ports in the northeast are helping researchers tune the system and develop procedures to enable accurate threat detection, while minimizing the impacts on port operations.

Synthetic aperture radar (SAR) systems engineered and manufactured by Sandia

show promise for Homeland Security applications. Able to image broad areas at high resolution and to collect data at night and in inclement weather, SARs are already having an extraordinary impact on the conduct of battle. Advances are increasing their value and applicability. In one example, Sandia has engineered SARs into event recorders that allow viewers to detect sub-millimeter changes in landscapes over a period of time, such as the appearance of footprints over grass or leaves rustling in the breeze. The ability to perceive these subtle changes has homeland security implications, particularly in border monitoring.

Protecting against radiological and nuclear threats

Our long-standing mission to secure the nation's stored nuclear weapons has positioned Sandia to provide exceptional countermeasures against radiological and nuclear threats. Our assets include expert staff with a deep understanding of security issues,





Sandia's Operation America events to train bomb technicians continue to draw accolades from law enforcement officials.

as well as a research and development program that spans the range of activities needed to address homeland security.

Our work is already having an impact. Sandia's radiation detection capabilities are opening new possibilities for ensuring a higher degree of protection at vulnerable points. Our threat characterization expertise has helped partners around the world. And our sampling and signature proficiency is adding to our forensic competence.

Sandia is also contributing to a larger DHS program to develop short- and mid-range radioactive/nuclear countermeasures. Efforts include establishing scenarios and defining performance metrics to evaluate alternative countermeasures; designing, simulating, and evaluating sensor networks and response strategies; and completing a source signature database for radiological dispersal devices, or so-called dirty bombs.

Bolstering cyber security

In fulfilling its primary mission, Sandia develops intricate computer systems that operate in complex environments—and that are subject to thousands of attacks daily from adversaries of all types.

To protect the integrity of its data, Sandia has actively secured its online network and transmission systems and built up a comprehensive array of tools and deep expertise in cyber security. Our Information Operations Red Team and Assessments program has performed cyber system assessments, evaluations, and vulnerability experiments for a broad range of systems. Customers include civilian government agencies, DoD, industry, and operators of critical infrastructure assets.

Sandia researchers are also developing information security practices to meet the next generation of Internet threats. Tools in our portfolio include Standard Agent Architecture II/Agent-in-a-box. These intelligent agents not only contribute significantly to national security, but also represent substantial commercial value for the multibillion-dollar cyber security industry.

High explosives countermeasures

Sandia stands among the world leaders in developing solutions to the most difficult challenges of developing countermeasures to explosives. Our work includes conducting research and development in counter-explosives technology, characterizing explosives and their blast effects, performing vulnerability assessments that highlight areas for improved defense, and identifying ways to harden buildings.

Our work to understand explosives properties led to the development of Sandia's patented advanced sample collection and preconcentration technology, now used in many applications. The hand-portable

explosives detector MicroHound™, for example, employs Sandia's sample collection and preconcentration techniques and microsensors to improve detection capabilities and lower unit costs. Sandia also integrated the technology into the design of a portal to detect trace explosives on people and in a vehicle detection portal. The personnel portal has been commercialized by Smiths Detection, and the vehicle portal is now under field test.

Other Sandia work is improving the nation's response and forensic capabilities. Sandia's Percussion-actuated Nonelectric (PAN®) Disrupter, for example, allows remote disabling of improvised explosive devices without initiating the explosives or destroying evidence. A Sandia-developed aqueous foam suppresses explosive blasts, reducing potential damage. In addition, through Operation America, Sandia has hosted workshops in advanced bomb-disablement technology for bomb squad personnel.

Safeguarding critical infrastructure

The nation's well-being depends on the smooth operation of vital infrastructure, including energy, communications, transportation, finance, water supply, agriculture, and emergency services. With growing automation, once-separate infrastructures are increasingly interdependent, and disruption in one sector—through a physical or cyber attack—can quickly cascade into multi-sector failures, imperil lives, and affect national security.

The National Infrastructure Simulation and Analysis Center (NISAC)—operated jointly by Sandia and Los Alamos National

Laboratory—was established to provide an understanding of interdependencies among the critical infrastructures. Through modeling and simulation, NISAC is building expertise in infrastructure interdependency analysis and identifying potential vulnerabilities and consequences of disruption. This knowledge will enable better prevention and response planning, investment decisions, and first responder training.

Sandia has conducted wide-ranging risk assessments on behalf of many national agencies. Further, Sandia security experts have traveled the country to develop and apply security assessment methods and other risk-management tools for dams, power systems, government buildings, chemical plants, water supplies, and other infrastructure elements.

Notable studies include assessing the management systems and security practices of the U.S. Bureau of Reclamation, the nation's second largest producer of hydroelectric power. This project, which led to the integration of the latest supervisory control and data acquisition technologies at six hydroelectric projects, is now providing similar input for five additional dams.

Sandia also participated on a multi-lab team engaged by the NRC to analyze the consequences of specific terrorist threats on nuclear plants. Two ongoing plant-specific assessments are refining the insights gained in the initial study. Sandia has performed similar studies for NNSA and DoD facilities.

